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Report – Phase I
Environmental Standards and Norms for Clean Production in
the Cement, Tanning and Metal Finishing Industries

Institutional Support for Sustainable Environmental
Management of the Panama Canal Watershed

Prepared by:
Comité Técnico Interinstitucional de Producción Más Limpia
Consultants to International Resources Group, Ltd.

Prepared to:
Ricardo Anguizola
Administrador General
Autoridad Nacional del Ambiente

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Report – Phase I

Environmental Standards and Norms for Clean Production in the Cement, Tanning and Metal Finishing Industries

I. Background

Law 41 of July 1, 1998 establishes a national policy in Panama to promote environmentally sustainable behavior and the use of clean technology. The law also calls for national policy to give priority to mechanisms and instruments for the prevention of pollution.

The same law requires that the National Environmental Authority (ANAM) issue norms and standards that address environmental impacts of private sector activities and promote the national clean production policy of Law 41. ANAM, working with the Ministry of Health and the Ministry of Commerce and Industry, which also have the responsibility to promote clean production, wants to adopt temporary international norms and standards to encourage clean production. These temporary international standards would be replaced over the course of the next few years with permanent standards specifically designed for Panama. This activity was developed to support Panama in designing regulations to encourage clean production and sustainable economic growth while simultaneously protecting the environment.

Specifically, this activity offered technical assistance related to three key industries: cement, leather tanneries and electro-plating/metal finishing. The purpose was to present recommendations for a normative approach for these three industries that ANAM can adopt as appropriate based on an assessment of the relevant industries and international norms and environmental standards.

II. Activity Description

This activity followed up on preliminary, short-term support to ANAM by a team including one senior attorney and two engineers that outlined technical and policy aspects of industrial clean production for ANAM and its counterparts and devised a strategy for developing policy and normative recommendations for Panama. On the basis of the preliminary outline approved by ANAM, the consultants recommended the creation of an inter-institutional technical committee, and guided that committee through the process of identifying a range of options for the adoption of norms and standards to encourage clean production in Panama. These options can be used to guide ANAM in its efforts to convert the Panamanian industrial infrastructure from one focused on end-of-pipe technology to one focused upon clean production practices and prevention of industrial emissions and effluents. Activities included:

- A series of “audit lights” designed to identify key areas where clean production options might be supported by government policy;
- a review of current environmental and other relevant laws in Panama;
- meetings with the private sector and ANAM;

- recommendations on the structure and function of an inter-institutional technical committee and guidance to that committee in assessing options and making final recommendations for policy choices;
- presentation of regulatory options and final recommendations to encourage the paradigm shift; and
- development of general content for clean production mechanisms.

III. Relationships and Responsibilities

The consultants worked under the direction of IRG (reporting to the IRG resident Chief of Party) in consultation with ANAM. The consultants interfaced with industrial representatives and associations identified by the governmental entities involved in the promotion of clean production. The purpose of this interaction was to identify examples of norms for clean production that could be adopted in Panama to reduce, prevent and manage industrial emissions. The consultants interacted with the industries that will participate in the audit-lights, government officials, private sector representatives, and other relevant entities.

IV. Findings and Recommendations

A. Technical Findings and Recommendations

The audit lights resulted in a series of findings outlined more fully in a field report provided for translation and distribution among interested parties. In essence, the recommendations can be summarized as follows:

1. Adopt the ANAM/Ministry of Health – Proposed Pre-Treatment Standards for Effluents to Surface Water and Sewers

By early July 2000, the private sector will have had their last opportunity to review the proposed LMPs for waste water. The technical team recommends that ANAM adopt all of these LMPs that survive this or any other comment period. When we reviewed these LMPs in March 2000, we felt that perhaps a few were beyond detection limits for industry and/or ANAM at this point in time. ANAM should adjust these LMPs upward to detectable levels. With backing by the BID, ANAM should be able to acquire the necessary laboratory equipment and training to be able to support and enforce the listed standards. We have also recommended a review mechanism which affords industry the option of presenting their technical case to ANAM offering proof that a given standard(s) would be impossible for them to meet. ANAM and that company would adjust the standard as required.

Setting these LMPs will force the private sector to measure all of their inputs and outputs to get a quote on building a waste water pre-treatment system to meet the LMPs. Experience has shown that avoiding a certain future sunk capital cost for treating waste water is one of the best motivators for clean production.

It is our opinion that these numbers are strict enough to help to protect human health and the environment and with an appropriate review mechanism they will also be flexible enough to work well for clean production and industry.

There is a risk that industry will reject regulations based on these LMPs. However, it is this short-term, negative atmosphere that opens the door to clean production. The companies will have to look to modify their processes to improve efficiencies if they hope to reduce their capital and operating costs for waste water pre-treatment plants. If the private sector rejects these standards and compliance is very low, human health and the environment will still be in great danger.

ANAM could have chosen more strict standards, but in our opinion, that would not have been an effective strategy at this time. Higher standards than those proposed would be more costly, more difficult to achieve and would probably depress compliance rates. High compliance rates are important for a credible and effective environmental regulatory agency and for a clean, profitable and healthy industrial eco-system.

2. Establish LMPs for Dust, SO_x and NO_x for the Cement Industry

Based on our visits to the two cement plants, we first recommend adopting a two-tier plan for air pollution LMPs good perhaps for the next three, four or five years. After that, both plants should have to meet the same, more strict standards. Both plants have special circumstances that merit a creative and flexible approach to maximize benefits to human health, the environment, the economy and the prestige and power of ANAM.

Cemento Bayano uses the dry production process. Bayano is part of a worldwide cement conglomerate that has been able to improve plant efficiency and environmental performance since CEMEX acquired them several years ago. They face strong corporate pressures to measure up to other, more modern plants within the CEMEX system of over 40 cement plants.

We were not able to verify what limits for the three criteria air pollutants that they could meet with today's production processes and environmental controls. In our estimation, they could meet a limit of 150 micrograms per normal cubic meter ($\mu\text{g}/\text{Nm}^3$) of particulates for the cement kiln. Kiln dust is the area of greatest concern; dust emissions from other operations are lower and easier to control. This ($150 \mu\text{g}/\text{Nm}^3$) is the LMP for cement kiln dust in Spain. Bayano only has an electrostatic precipitator (ESP) on their kiln and to reach, for example, $100 \mu\text{g}/\text{Nm}^3$, they would have to add a baghouse after the ESP. This would cost several million dollars.

For SO_x and NO_x we were not able to verify their ability or inability to meet a given standard. SO_x could be a problem for Bayano because they burn petroleum coke with a sulfur content of 4.3%. Cemento de Panama burns low sulfur coal from Colombia (less than 1% sulfur) and will have no problem meeting any SO_x standards set for the future. Bayano may have to install scrubbers to remove SO_x or switch to a more expensive fuel. Petroleum coke is a waste from oil refineries and is less expensive than coal from

Colombia. As a note, every cement plant in Peru burns Colombian coal. Perhaps CEMEX has the buying power to acquire the petroleum coke and use it where it is able within its worldwide network of plants.

Cemento Panama uses the wet production process. They began operations 52 years ago and have virtually no means of controlling kiln dust. They must burn approximately 40 to 50% more fuel in their kiln to evaporate the water that comes in with the raw meal. Their fuel inefficiency would emit more pollutants per ton of product than would a dry manufacturing process were all other things equal. Cemento de Panama has long recognized the competitive weakness of the wet process and are eager to upgrade parts of their operation. It is this internal and external drive for process efficiency that will deliver the needed environmental benefits at both cement plants.

Therefore, we recommend that ANAM put in place temporary standards for the next three, four or five years. This will give both plants enough time to design, buy, install and operate process efficiency upgrades or add-ons. We recommend that these temporary standards be different for each plant to reflect the real differences between wet and dry processing and the equipment that make up these two processes.

When CEMEX took over Cemento Bayano and began to improve process efficiency they further widened their competitive advantage over Cemento de Panama. Today, they continue to improve overall efficiency and reduce emissions. Cemento de Panama was forced to set into motion, plans to operate more efficiently and cleanly. It is our opinion that these changes are very good for Panama, its people and its environment and that ANAM should facilitate the acquisition, installation and operation of new process components that the two companies want and need.

***Table 1: Summary of Net Environmental and Financial Benefits
Estimated Potential Reductions for Selected Contaminants
By Implementing Clean Production Process Changes***

Contaminant	Estimated Benefit	Assumptions, Calculations and Comments
CO ₂	> 500,000 tons per year	Based on total energy consumption, wet vs. dry operations in US; coal with energy content of 8E9 calories per ton; and, 3.67 tons of CO ₂ per ton of coal
Kiln Dust	> 500 tons per year	Based on estimated dust emissions of wet plant without an electrostatic precipitator (ESP) and baghouse vs. dry process with dust controls
Kiln Dust	\$50,000 per year	Value of dust captured in ESP and baghouse
Cr ₂ O ₃	> 30,000 kg per year	Based on both tanneries reusing their chrome solutions that would save them approximately 30% of their annual purchases of this imported salt
Cr ₂ O ₃	> \$90,000 per	Imported salts contain 25% Cr ₂ O ₃ and cost

	year	approximately \$0.80 per kilogram
Tanning Solids	> 500 tons per year	These solids contribute to the BOD ₅ and COD (DBO and DQO) loading that can be kept out of receiving waters and sewers

**Table 2: Criteria Air Pollutants LMPs
Cement Plants Built Before 1960
Effective Until January 2004**

SOURCE	LMP
Kiln Dust Particulates	600 µg/Nm ³
Kiln SO _x	800 µg/Nm ³
Kiln NO _x	1,000 µg/Nm ³
Cooler Dust Particulates	400 µg/Nm ³
Milling, Grinding, Conveying or Bagging Dust Particulates	400 µg/Nm ³
Opacity	25%

**Table 3: Criteria Air Pollutants LMPs
Cement Plants Built After 1960
Effective Until January 2004**

SOURCE	LMP
Kiln Dust Particulates	150 µg/Nm ³
Kiln SO _x	1,000 µg/Nm ³
Kiln NO _x	800 µg/Nm ³
Cooler Dust Particulates	200 µg/Nm ³
Milling, Grinding, Conveying or Bagging Dust Particulates	200 µg/Nm ³
Opacity	25%

**Table 4: Criteria Air Pollutants LMPs
All Cement Plants
Effective from January 2004 until Revised**

SOURCE	LMP
Kiln Dust Particulates	100 µg/Nm ³
Kiln SO _x	400 µg/Nm ³
Kiln NO _x	500 µg/Nm ³
Cooler Dust Particulates	50 µg/Nm ³
Milling, Grinding, Conveying or Bagging Dust Particulates	50 µg/Nm ³

Opacity	15%
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Notes: All values for particulates from kilns have been corrected to 7% oxygen. A normal cubic meter Nm³ of gas is defined as dry gas at a temperature of 25 degrees C and at a pressure of 760 mm of mercury.

Table 5: RANGE of LMPs for Dry Process Plants
Taken from Data Available to Consultant
Sources: USEPA, World Bank, Thailand, Indonesia,
European Union, Germany, and the US Portland Cement Association

SOURCE	LMP RANGE
Kiln Dust Particulates	20 to 400 µg/Nm ³
Kiln SO _x	200 to 1,200 µg/Nm ³
Kiln NO _x	200 to 1,800 µg/Nm ³
Cooler Dust Particulates	20 to 400 µg/Nm ³
Milling, Grinding, Conveying or Bagging Dust Particulates	20 to 400 µg/Nm ³
Opacity	15 to 40%

It must be clear that the numbers in Tables 2, 3 and 4 are judgments based on the following factors:

- Current technology in each plant;
- Technology available for each plant to purchase;
- Political forces in other countries influencing their LMPs;
- Market forces inside and outside of Panama;
- Political influence in Panama;
- Costs to operate a cement plant; and,
- Costs to upgrade a cement plant.

Worldwide, cement is a commodity and the environmental impact of its production in most cases is determined by what equipment is used and its condition. The industry is under pressure in all countries to improve and the vendors of cement manufacturing equipment are well aware of this and are constantly trying to improve their wares. The vendors can and will innovate at a rate that will be sufficient to meet environmental standards in the most demanding countries, Germany, for example, who is considering setting a kiln dust standard of 20 to 30 µg/Nm³. A manufacturer cannot afford to make two models of kilns with ESPs and baghouses; one for Germany and a “dirtier” one for the rest of the world. Equipment purchased today will need to work for Germany’s strict standards.

The numbers in Tables 2 and 3 represent the technical reality in each plant today and a realistic timeframe to change that reality for the better. That is the reason for one set of LMPs for plants built before 1960 (Table 2, the wet process at Cemento de Panama) and

another set of LMPs for plants built after 1960 (Table 3, the dry process at Cemento Bayano). Cemento de Panama is planning to buy some new equipment that will make them much more efficient and cleaner. This will take some a few years to obtain permits, purchase, install, and troubleshoot before it could reach more strict limits. If they go ahead as planned with the acquisition of new components, in the long run, this is better for human health and the environment in Panama. Forcing them to make improvements sooner by patching up the existing process is both bad business for the company and, in the long run, bad for the environment.

Cemento Bayano has a different current reality and timeframe for change. They already have a manufacturing process that with some additions and enhancements will be able to meet all but the most strict standards envisioned by ANAM. With a baghouse after their electrostatic precipitator they would meet kiln dust standards and with either cleaner fuel or some scrubbing system, they would meet SO_x standards. The proposed LMPs in Table 3 take into account that Bayano has an ESP, a pre-heater and a pre-calciner, that is why the kiln dust is set at 200 µg/Nm³. The SO_x limit is higher than in Table 2 because Bayano burns high sulfur petroleum coke.

We might imagine why is Cemento de Panama thinking about buying some new equipment. Certainly some credit goes to management for realizing that the Panamanian government would demand that they improve their operations. Another large force was CEMEX acquiring their competitor. That should also work again, in favor of cement quality and human health and the Panamanian environment. If Cemento de Panama does buy some new equipment that helps them to make better cement at a reduced cost, then Bayano will be more likely to get capital within their corporation to stay competitive.

To take advantage of the opportunity to significantly improve the environmental impact of cement manufacturing, ANAM will, for some time, have to be a facilitator. To be effective in this role, it is likely that ANAM will have to find a way to make each company will feel that they have been given preferential treatment. They will like that when it works in their favor but they may object if their competitor benefits.

Splitting the temporary LMPs into categories for plants built before and after 1960 (or date of your choosing) will allow Cemento de Panama to continue to operate and pollute as is. Leaving the temporary limit for SO_x quite high will allow Bayano to continue to use their dirty, but inexpensive kiln fuel. Perhaps each will feel that they have had their fears and needs properly addressed and they will allow the process of setting LMPs to proceed quickly without interruptions. After the adjustment period of three, four or five years, ANAM should then demand performance much closer to world standards (Table 3).

We did not meet with community groups and since we had confidential information, we had nothing with which to approach the public. It is hard to gauge what their response would be. In the case of Cemento de Panama, would the public be willing to accept three, four or five more years of uncontrolled emissions in return for decades of cleaner operations? Even after all that, would ALL of them be satisfied? Would they accept higher SO_x emissions from Bayano so they can use a less expensive fuel that is someone else's waste?

In the U.S. LMPs for the cement industry are based on production (kg of dust per ton of clinker) and not based on concentration (micrograms of dust per normal cubic meter). There are only two cement plants and both operate in the same physical conditions. This means that the standards proposed in Table 3 are similar to production-based standards.

3. General Observations regarding the Audit Light Process

We spent only a few hours in each plant. Even with that limitation, we are confident that for the plants that we visited, there are excellent opportunities to demonstrate the value of a clean production approach to environmental policy. Table 1 at the beginning of the report shows the potential net environmental and financial benefits that Panama would realize if the companies that we visited would apply the recommended clean production principals to their operations. We have tried to quantify these benefits where possible.

Because of its visibility, the cement industry is an important sector and success there is very valuable. ANAM will be able to claim that setting strict limits for cement plants was a major factor in decision making. The facilities plan to purchase new equipment and controls that reduce the environmental impact of cement manufacturing. The timing for working out a plan with the cement industry to influence their investments in new equipment could not be better.

For tanneries, we visited two plants that together, represent over three-fourths of the hides tanned in Panama (Teneria Progreso and Teneria Tauro). We have recommended that they reuse their waste chrome tanning baths. If successful, these two companies could save more than \$90,000 by not having to purchase imported chrome salts that they import. This would also eliminate the un-controlled disposal of over 30,000 kg of Cr_2O_3 into Panama's environment. We have also recommended that they separate their liquid waste streams as follows: pelambre, chrome tanning, and all others. Segregation is essential to reusing chrome tanning solutions.

By separating the pelambre waste from all others, the operators can manually remove solids instead of paying for a waste water pre-treatment system to do it. We have made other, simple suggestions, too, but these first two will have the largest impact. We expect that if the companies succeed, they will have saved enough money that they will be able to afford a waste water pre-treatment system that can meet the proposed effluent guidelines. Without the process changes first, meeting the proposed guidelines would be too expensive; worse, with mixed waste streams and large volumes, the pre-treatment itself would be less effective.

Metal finishing is a very broad field. We do not know how large it is in Panama because we only saw three companies, two rather large ones and one small one. Each plant had opportunities to modify parts of their production processes in ways that would reduce both the volume and toxicity of their waste water.

One company, CorreAgua, could close the loop on their only industrial waste water stream. Some people could call the volume and toxicity of this waste stream insignificant,

and it is true that Panama faces greater challenges and dangers. But what a compelling story: a Panamanian company collaborates with ANAM and USAID Panama to modify their process, sharing with others the internal decision making process, risks and rewards of making it to zero discharge! If successful, they will not need any wastewater pre-treatment at all.

This company had another significant clean production opportunity in their barrel painting line. There are vendors who supply paint booths that capture the overspray (paint solids that miss the work piece; typical solutions are to catch the overspray in a water curtain or air filters). A simple spray paint operation like we saw at CorreAguas may have a transfer efficiency of less than 50%. This proven paint booth lets the operator capture and reuse up to 98% of this overspray. The operator saves on paint purchases and has very little loss (contamination). CorreAguas had other minor opportunities but in general, they were a very well-run company and they were eager to solve these two particular problems.

Aluminio de Panama is another very well-run company. They, too, have some important process improvements and acquisitions that could make a measurable difference. They currently discharge waste water. Clean production changes will minimize the loading and volume of their discharges. Luckily, they have a little extra floor space that they could use to modify their cleaning and coating processes to reduce use of raw materials and water. We have also given them instructions on how to modify some of their to reduce the mixing of water with toxics. This would reduce their capital and operating costs for a waste water pre-treatment system needed to meet the proposed standards. We also recommended smaller adjustments to another coating process that would reduce wasting.

The venerable owner of the small plant (Clavos y Alambres) has the experience and knowledge to modify rinsing practices that would lessen the impact on receiving waters. It remains to be seen if he is willing to risk any significant modification to a process that he created. In our opinion, he might be more motivated once he had a firm quote from an engineering firm for the cost of treating his waste water. Even though his waste water volume is small, the capital costs for a pre-treatment system would be more than enough to motivate him to modify his processes.

4. Estimation of Economic and Environmental Benefits of Using Clean Production

Economic and environmental benefits come from improvements, over some baseline, in the way producers or manufacturers use raw materials, natural resources, energy and toxic materials. Any estimations of savings or environmental improvement are independent of new norms or regulations.

The process parameters for the tanneries were easier to identify and verify. If the tanneries implement CP changes, the primary financial benefit will be from reduced purchases of chromium tanning salts. Reusing chromium tanning baths will save the companies approximately 30% of their overall cost of chromium salt purchases and eliminate trivalent chromium from the effluent. Aggressively removing solids from all bath dumps will reduce BOD₅/COD loading by as much as 90% and ultimately reduce the capital and operating costs of a wastewater pre-treatment system. These two improvements are key.

They are inexpensive and proven. If the two, large tanneries are not willing to make these changes then it is unlikely that they would be willing to make other, meaningful changes for CP.

Process and cost parameters are a bit more elusive in the cement industry, and it is unlikely that the cement industry would be willing to disclose accurate costs or process details. Together, the companies have a duopoly in Panama and it would be better to let them estimate their financial and environmental benefits more accurately than calculations that I made in my earlier technical report to USAID and ANAM.

The metal finishing industry is just too broad and two hours in a plant is not enough to gain the confidence of the owners to divulge such sensitive information.

5. Clean Production Indicators for the Three Key Industries

An indicator must be relatively simple to measure, meaningful and measure progress toward CP goals. While there may be many indicators that one could measure, in almost all instances, a company really needs to focus on just two or three. Sometimes, improving a given indicator may also improve (in a CP meaning) another part of a process that could have its own indicator. But in such a case, for example, total facility water use per unit of output (liters of water per ton of white limed hides for tanneries) reducing facility water use requires progress on a broad front within the plant.

Tanneries

- Kilogram (kg) of trivalent chromium (Cr^{+3}) per ton of white limed hide – should be zero if the tanneries reuse their chrome tanning solution as recommended; typical readings from the large tanneries in Panama might be over 10 kg per ton
- liters (l) of water per ton of white limed hide – could be as high as 80 l/ton based on observations, 50 l/ton is certainly achievable but the very best tanneries can get as low as 25 l/ton

Cement

- Kilograms of kiln dust per ton of clinker produced – could be as high as 0.5 kg of kiln dust per ton of clinker at Panama but for both companies, they should shoot for 0.15 kg/ton with a world's best at approximately 0.075 kg/ton
- Kilograms of dust per ton of cement in the grinding phase – have no idea what the levels could be at either plant but they should shoot for 0.03 to 0.05 kg per ton of cement
- Kilograms of dust per ton of clinker in the cooler – same comments as above for grinding
- Ton of fuel consumed per ton of clinker produced – Bayano is a dry process and will be much lower in this indicator than will be Panama; but 0.15 is a respectable ratio and 0.10 is very good

- Electric power (kWh) per ton of cement produced; 150 kWh per ton is respectable and 100 is very good¹

Making cement and tanning leather are very similar industries. Each sector begins with natural raw materials and modifies the inputs to reach a consistent final product: cement or leather. This consistency makes it simple to develop logical and useful CP indicators. Metal finishing is entirely different. It can begin with all sorts of base materials destined for endless uses. The sector is quite broad, but I did not see enough facilities to create any meaningful indicators in such a short time.

6. Outline for the Content of Audit Lights and the PAMAs, Including Clean Production Plans – With Recommendations for Each of the Three Key Industries.

USAID has already paid for several PAMA outlines and I recommend that Panama's ANAM use the work from Peru as more than an outline to develop a PAMA guide. I have attached their PAMA Guide for the tanning industry, in Spanish. I recommend this as a good start for something more than an outline with the following changes:

- Start off right away with an outline of a good PAMA, do not wait until page 25
- Strongly recommend that they use a CP approach to make all process decisions
- Tell them that you want them to implement as many CP changes as possible
- Tell them that you want them to justify any nominal CP changes that they might refuse to make

Be prepared for the regulated community to voice concerns about the PAMA process. They may be apprehensive about possibly disclosing process secrets or the size of their business (tax implications). They may also be skeptical about the qualifications of government employees to effectively review their plans for adequacy. Responding to these concerns is difficult. For that reason, I also recommend that ANAM make the guide brief and businesslike: DO NOT include any process flow diagrams or process descriptions. The manufacturers know their process and it is their responsibility to hand over their own version of their process flow diagram. If ANAM feels that they must also discuss the antecedents of the PAMA process, do so at the end of the report and allow for anyone who has to write the PAMA to get the work done first and find out about the background later.

In the US, over half of the states have laws that require large hazardous waste generators to develop a clean production plan as part of their permission to continue operating. I have attached the guide documents from Oregon, Minnesota and Texas as examples and references. The United Nations Environment Program (UNEP) has, in Spanish, a guide on how to perform a clean production audit. I have included a reference on how to buy the document in the Appendices.

ANAM should require specific, CP analyses in their PAMAs from the three key industry sectors. From cement, ANAM should require that they show what are their current CP

¹ The mills that grind the clinker into cement powder run on electricity so the appropriate denominator is "ton of cement produced".

indicators, how they calculated these indicators and what they will do to improve them. If a company says that they cannot improve one of the key indicators, they should be required to quantify and justify their position. For the tanneries, their PAMAs must show that they have thoroughly evaluated aggressive solids removal from all bath dumps and chromium tanning solution reuse. If they intend to implement these changes, then they should show a schedule. If they do not intend to implement either of these changes, they must be able to show clearly that they cannot do so. Again, for the metal finishing sector, providing specifics is not possible because of the broadness of the sector and the brief, two hour visits to each of the three plants.

7. Recommend a Certification Program for Industries Adopting the Concept Of Clean Production

Industry is actively polluting and they should not be allowed to remain passive and then expect to be rewarded for making corrections. It must be the responsibility of industry to certify that they are operating properly: not wasting raw materials, natural resources, energy or unnecessarily using toxic compounds. Government should review what the industries say and decide if they are being accurate. ANAM should avoid the pitfall that it is their job to develop a certification system to “reward” industry. Reward them with publicity for MEASURABLE AND VERIFIABLE progress toward CP goals but certification is too broad. Who will certify the certifiers?

ANAM should publicize the sectors required to deliver a PAMA with a CP component. ANAM should list the individual companies in these sectors that are required to comply and include the compliance schedule. Then, as each company complies with the PAMA/CP provisions, ANAM should publicize their “good work” and continue to publish the names of those who have yet to comply. That will motivate the companies to cooperate with ANAM and get “certified” that, at a minimum, they have done the required paperwork.

Beyond that, passing out “Green” seals of approval is too risky for ANAM. A seal of approval connotes stasis whereas CP is a dynamic, ongoing process. The first three industrial sectors do not lend themselves to a “Green” designation. Is there a “Green” way to extract, transport and burn limestone? Not really, but if a cement plant in Panama can do so and match the global benchmark for kg of kiln dust emissions per ton of clinker, then they are doing what ANAM, the public and the environment need them to do. If a tannery reuses their tanning baths and no longer emits wastewater with any chromium in it, then it is they who should certify such a positive fact by advertising that they can produce leather in Panama without the toxic wastewater emissions of before.

8. Recommendations on Resources for Cleaner Production Training Within and Outside Panama

The most important step in making training recommendations or developing and delivering training for CP is to assess the needs of all important players. ANAM can simplify things by assuming that everyone needs all the CP training that there is available. ANAM’s first task is to raise CP awareness for all of Panama: government; academia; industry; the public;

financial institutions; NGO's; etc. I strongly recommend that ANAM focus within ANAM and the Ministry of Health to start and from there, branch out into all other government agencies (and levels) next. The goal is to spark a flame of enthusiasm within the government to use their existing power and position to promote CP. It is important that industry recognize that government has a coherent message on CP and that it is supported by TOP MANAGEMENT within all levels of government. This awareness training (campaign) will be an ongoing component of all subsequent training.

To get this done, ANAM has to go first. ANAM should identify specific technical and operational areas where they themselves want training. For example, any and all government inspectors should have training on what is CP (and more importantly, WHAT IT IS NOT!), how it fits in with their duties, and what might be done to help pass on information available within Panama about CP and how to direct companies to technical assistance. The next step (probably should be concurrent with ANAM training) would be to develop CP training for industry: what is it; why is it good for you; what will it take to make it happen; how to do financial analyses that take into account CP benefits; where to get technical assistance; who are proven experts; etc. Any additional training would be quite focused and demand driven. At this point, ANAM could reasonably expect that the training would be paid by the recipient.

There is no shortage of good material already available for ANAM to put to work for their needs in Panama. The Interamerican Development Bank (BID) is funding a CP training project in El Salvador that will have over 15, week-long CP courses and over 15 week-long field training events (for the same industrial sectors that matter for ANAM) over the course of the next few years. ANAM could either send participants to the El Salvador events or coordinate with the BID contractors to deliver their products in Panama as well.

There is a schism in the tight-knit CP training profession between those who have content and field experience and those who are true teachers. Those who are experienced CP field hands usually feel most comfortable lecturing about "facts" that they know. They want to "transmit" their knowledge and experience to the class. The teachers may lack specific content knowledge but know well how adults learn and craft their course to be participatory. I came from the technical side but have had the privilege to have worked with the best CP adult trainers and firmly believe that you have to have both working in harmony.

The US EPA has two superb trainers who have both teaching and field experience. They have developed a complete "Train The Trainer" program that will do exactly what I am recommending. It is designed to raise awareness of CP and to train others to spread the word. Also, the Toxics Use Reduction Institute (TURI) at the University of Massachusetts in Lowell, MA has very good personnel with experience in Latin America with the experience that ANAM will need. I am attaching the US EPA course material. ANAM may reproduce it and distribute it if they prominently give credit to the US EPA for their work. ANAM may also want to contact the National Institute of Water (INA) in Buenos Aires, Argentina. The US EPA field-tested their course work there and INA may have translated the works into Spanish.

B. Legal and Policy Findings and Recommendations

The following findings and recommendations have been provided to relevant parties in English and Spanish.

1. Background

In order to fulfill its mandate under Law 41 of 1998, ANAM began a series of consultations and analysis in early 2000 concerning how best to promote clean production in Panama through legal and regulatory policy. This process included dialog among relevant governmental representatives and consultations with interested businesses, academic and non-governmental organizations.

Initial consultations led to the identification of a number of key industries as priority targets for early action on clean production. To support further specific analysis, technical surveys were conducted of representative facilities in the first three sectors identified for early action: tanneries, cement facilities and metal finishing facilities.

In order to further a meaningful process of consultations, and to promote continuing analysis and review of clean production policy, the Director of ANAM established an Inter-institutional Technical Committee on Clean Production (CTI) on July 1, 2000 by Resolution A.G. N° 0199-2000. The CTI's members include a range of representatives from the public and private sectors, and it is authorized to consult with other professionals and sectors as specific issues arise. The CTI's mandate, as outlined in the resolution, is to:

- Promote those elements and policies of clean production that can form part of the environmental norms and standards for specific industries or sectors;
- Make recommendations to ANAM with respect to clean production plans for specific sectors;
- Formulate mechanisms that will provide incentives for advances in efficiency through clean production;
- Make efforts to establish a Clean Production Center in Panama; and
- Publish an annual report, beginning in 2002, describing progress in clean production at the national level.

As of the date of this report, the CTI has met several times to review the technical recommendations regarding tanneries, cement and metal finishing facilities, and to discuss policy options in the context of Panama's overall environmental and sustainable development goals. Representatives from the affected industries have been present during these discussions, and their input has been considered. In addition, a survey was used by CTI members to solicit views from interested persons outside the consultative meetings.

At the meeting of the CTI, on September 28, 2000, specific policy recommendations were discussed for promoting clean production within the first three target industries. The CTI established a drafting sub-committee to put specific recommendations in writing.

The recommendations that follow are drawn from this process, and are presented for further consideration by the drafting subcommittee and the CTI.

2. General Recommendations

These recommendations fall into two categories: general recommendations that will have relevance for most or all industry sectors in Panama, and specific recommendations for the first three target industries.

It should be noted that the first three general recommendations (A – C) are considered a priority, because they will create a basis for the successful application of the remaining policy recommendations.

- Clarify Plans for the Enforcement of Panama’s New Water Discharge Standards

ANAM issued water discharge standards earlier this year that regulate the discharge of specific contaminants from industrial operations. In order to promote the adoption of cleaner production practices and sound environmental management, and to promote investments in clean technology, businesses should be informed about the government’s specific plans to enforce these new standards. In particular, the government should specify: *when* the standards must be met, and *what penalties* will be assessed for those facilities that fail to comply. Although companies can use a number of approaches to comply with these standards, including end-of-pipe methods, there will be a much stronger incentive to adopt cleaner production methods where the government sends a clear signal that the new limits *will be enforced*, and provides sufficient advance notice to the relevant businesses.

Experience in many countries, including the testimony of business leaders themselves, shows that the certainty of enforcement is a powerful incentive for clean production. If a business knows that it will receive a penalty for failure to comply, it will know that it costs more to operate inefficiently. A clear policy of enforcement establishes a baseline of behavior that is expected of each facility, and it promotes fairness by assuring that those companies who invest in compliance will not lose competitive advantage to those who fail to make a similar investment..

This report does not make a specific recommendation about when penalties will be charged, nor what amounts will be charged. That is a question for the government to answer on the basis of its assessment about how realistic the standards are, and how long most businesses will need to comply. In many cases, it might be appropriate to delay the enforcement of standards, or to reduce penalties for violations that occur in the early years of the compliance program in order to soften the impact on businesses. But business owners should understand that, in time, and at a specific time, they will have to comply. This make compliance inevitable, and those businesses that choose clean production methods can make their efforts to comply less expensive.

- Establish a Panama Clean Production Center with a working group on policy, and with the CTI as a Board of Advisors or Directors

As Panama works to establish a national Clean Production Center (CPML) with financing support from the Inter-American Development Bank, two important features should be considered. First, the CPML should include a specific ***Working Group on Policy***, as a mechanism to connect the Center’s technical assistance efforts to ANAM’s policy efforts. By forming such a working group, the CPML can offer technical assistance that is consistent with governmental policy, and focus its technical efforts in areas that are deemed priorities at a national level. Such a working group can also strengthen policy efforts by linking the technical expertise that will be developed by the CPML to ongoing policy initiatives.

Second, the CTI should serve as a ***board of directors or board of advisors*** to the CPML. This will assure a positive and “real-time” link between policy and technical efforts to promote clean production in Panama, and it will assure that the new Center receives guidance from relevant government, academic and private sector institutions. The July 1 Resolution calls for the CTI to help establish a clean production center, and that mandate can be fulfilled by having the CTI function as an advisory or directorial board – particularly as the new Center is beginning operations. The CTI has already invested a great deal of time and resources into beginning a dialog about clean production options within Panama, and these efforts should be applied to maximize the success of the new Center, rather than spent in an unrelated and parallel process.

- Integrate specific questions about clean production into the “Environmental Action Plans” (PAMAs) required under Law 41

Law 41 requires that regulated businesses prepare and file regular Environmental Action Plans (PAMAs). These reports should include a description of clean production planning as part of the environmental management efforts for each business. By asking businesses to provide sector-specific information about environmental efficiency (units of pollution per unit of production), and to describe detailed plans to increase efficiency, the PAMAs will promote new thinking among businesses, and build an interest in more efficient process and technologies. This type of reporting will also provide a public record that ANAM can use to measure the success of clean production efforts in the long term (note that this is one of the mandates for the CTI).

The clean production portion of PAMAs does not need to be extensive, and can include only 2-3 questions that are relevant to clean production assessment and planning. Thus, it should not substantially increase the burden on businesses that are preparing PAMAs, but it will help focus environmental management efforts on clean production and pollution prevention.

- Study eco-labeling or certification as an option to promote consumer interest in and support for businesses that choose to apply clean production process and technologies

A program of labeling or certification for businesses that adopt clean production practices or clean technologies should be studied as a way to encourage consumer preferences for clean production that can reward more efficient businesses. These programs are not always easy to implement with standards that are fair and objective, so additional study is needed

to determine how such a program could be implemented in Panama. Specific questions that must be examined are:

What industries or sectors could benefit from a labeling or certification program as a means to promote clean production?

What *objective* standards can be developed to assure that a label or certification has real meaning to a consumer (and to avoid a program that is superficial or misleading)?

What is the proper role of government to support or encourage a labeling or certification program?

The study, or the implementation of a program, could take place through the Clean Production Center. Note that one basis for labeling or certification could be an ISO 14000 program (see below).

- Promote ISO 14000 certification by relevant industries in Panama

ISO 14000 is an established regime that recognizes businesses for planning and implementing environmental management programs, and it has been used to promote consumer confidence in the programs of certified businesses. While ISO 14000 is a typically private-sector initiative, it can be supported through government action, where the government promotes or sponsors capacity building programs, helps to train or give credentials to auditors, or recognizes the value of an ISO 14000 certification through regulatory programs (granting some form of relief to a certified business – *see below*) or government procurement policies (for example, preferring certified businesses in purchasing).

It should be recognized that ISO 14000 does not guarantee that a certified business has in place an adequate clean production program, nor does it guarantee any specific level of environmental performance (although certification is dependent upon compliance with applicable regulations). Instead, it requires that businesses think about environmental management practices, and develop and implement internal management procedures. This, in itself, can promote changes to more efficient practices and technologies by making a business more aware of its internal behavior.

As with a broader labeling or certification program, an ISO 14000 program could be promoted through the Clean Production Center.

- Design specific rules that grant regulatory relief to businesses that make clean production choices.

In combination with a program that sets specific deadlines for compliance and establishes specific penalties for those businesses that fail to comply, some effort could be made to give some relief from these mandates where a business devotes its resources to clean production. Regulatory relief can include a reduction in the amount of a penalty or a longer time to comply with a specific standard.

This policy recognizes that an investment in clean production practices (through training or process changes, for example) or cleaner technology might give a better environmental result in the long term. Thus, a business that makes such an investment can be given relief from specific deadlines or discharge targets in the short term.

Initially, such a program could be applied where a business makes a specific request for regulatory relief because it can demonstrate that its investment in clean production will lead to a better environmental result in the long term. As experience is gained with this policy, specific rules can be developed that make regulatory relief automatic for specific sectors in cases where specific investments are made.

It is important that such a program grant regulatory relief only where a clear objective showing can be made that cleaner production methods are put in place (proof that pollution is being reduced per unit of production) in order to be fair, objective and credible.

- Create a “safety net” for businesses that can demonstrate that a specific standard is impossible or highly impractical to meet

Again, in combination with a program that sets specific deadlines for compliance and establishes specific penalties for those businesses that fail to comply, some opportunity should exist for businesses to demonstrate that the deadlines or the numeric standard is impossible or impractical to meet. This program would place the burden of proof on the business to challenge a standard or deadline, but where that burden is met, it would avoid a harsh enforcement action and unfair penalties. Where a demonstration is made, an alternate standard or deadline would have to be established so that the standard is not lost completely. The regulatory relief should also be contingent upon filing a clean production plan targeted at the specific process at issue.

- Study the possibility of targeted tax incentives for clean production investments

During the dialog to date, participants have expressed substantial interest in some form of tax incentives for businesses to invest in clean production. In addition, the idea of incentives is promoted through Law 41, and in the Resolution that establishes the CTI. Incentives could take the form of increased tax deductions or accelerated amortization on clean technology purchases, reduced import duties on clean technologies tariffs, or favorable export treatment for “green” products or technologies produced in Panama. Experience in other countries has shown that such incentives can be effective, but they are quite complicated to design, and their impact depends on the nature and details of the national taxation system.

To determine how such incentives might function in Panama, further study is needed. This should include an analysis of both the legal and economic concerns raised by modifying the tax system, and it should be undertaken with the participation of relevant government agencies with the authority to levy and collect taxes in Panama. The Clean Production Center could play a role in this effort, particularly if it has a policy working group, as recommended above.

3. Industry-Specific Recommendations

▪ Cement Industry

ANAM should continue its dialog with the cement industry representatives with a view to establishing a specific numeric requirement for dust emissions as soon as possible. This number will form the basis for ongoing efforts by Panama's two suppliers of cement to assess their performance and make future investments in technological improvements. Because older and newer technologies are capable of very different performance, a bifurcated standard would be appropriate. Under such a standard, newer facilities would be required to meet a more stringent target because newer technologies are far more capable of reducing dust emissions.

With respect to newer facilities (those put in operation after 1995, for example) the specific number (the concentration of dust emitted from the facility expressed in milligrams of particulate per cubic meter emitted " mm^3 ") should be one that can be reasonably met on a routine basis. An informal survey of comparable national standards shows that in Mexico the standard is 80 mm^3 ; in Chile the standard is 150 mm^3 ; and in the United States the standard is somewhat more complex, but can be expressed as 50 mm^3 . The World Health Organization recommends 40 mm^3 . Consistent with these examples, Panama may wish to consider a standard in the range of 100 to 150, which could easily be met by a new facility. Consistent with the general recommendations above regarding regulatory relief, some relief from this standard could be given where emissions temporarily exceed the legal limit in extraordinary circumstances, but only if the business can show that it has in place a clean production program and that it is in compliance with applicable norms at all other times.

With respect to older facilities, a higher emission could be allowed, consistent with the capacity of the older facility. Some consideration should be given, however, to eliminating this exception over time to provide an incentive for older facilities to be upgraded. For example, the higher emission allowance for older facilities could be eliminated in 10 years, thus promoting a change to newer technology prior to that time. The "safety valve" policy, described above, could be used to grant some additional time for compliance if the business operating an older facility could show that it was impossible or impractical to convert to newer technology within that period, and that it was using all other means available to reduce its emissions.

▪ Tanneries

The general recommendations above can be used to promote clean production by tanneries, although special attention should be given to chrome discharges as a principal contaminant in the tanning process. Should import taxes be considered, chrome could be subject to a special tariff that would make it more costly to use, and therefore promote conservation. Funds collected from this special duty could be re-distributed among tanneries that demonstrate clean production practices, and the special tariff could eventually be eliminated where general adoption of clean production practices occurred across the industry. Again, it should be emphasized that such measures require further analysis with the participation of relevant taxing authorities.

In addition, because tanneries produce consumer goods that are broadly marketed and often exported, this industry is one that could benefit from a labeling or certification program (described above). Special attention should be given to the possibility of an eco-labeling pilot program for tanneries to encourage consumer preference for businesses that implement clean production programs.

- Metal Finishing

The general recommendations above can also be used to promote clean production by companies that use metal finishing processes. In addition, because solvents are a principal contaminant of metal finishing processes, some consideration should be given to promoting a recycling program for used solvents. Where specific businesses produce a quantity of solvent that is too small to make recycling economically efficient, a cooperative program could be developed to promote the collection of solvents and recycling by one of the participating companies, or by a business specializing in recycling. The Clean Production Center, discussed above, could serve as a focal point to organize such an effort.